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The Patent Office

Cardiff Road

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1. Your reference

PDG/21003

2. Patent application number

(The Patent Office will assign a number)

9824061.7

- 3 NOV 1998

3. Full name

each applicant (underline all surnames)

SNELL & WILCOX LIMITED

6 Old Lodge Place

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Middlesex TW1 1RQ

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

UNITED KINGDOM

5579784003

4. Title of the invention

Film Sequence Detection (NT4)

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

MATHYS & SQUIRE

100 Gray's Inn Road

London WC1X 8AL

UNITED KINGDOM

Patents ADP number (if you know it)

1081001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)

Date of filing
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

Yes

- a) any applicant named in part 3 is not an inventor, or
- b) there is an inventor who is not named as an applicant or

See note (d))

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	-
Description	3
Claim(s)	1
Abstract	-
Drawing(s)	3

10. If you are also filing any of the following, state how many against each item.

Priority documents	-
Translations of priority documents	-
Statement of inventorship and right to grant of a patent (Patents Form 7/77)	-
Request for preliminary examination and search (Patents Form 9/77)	-
Request for substantive examination (Patents Form 10/77)	-
Any other documents (please specify)	-

11.

I/We request the grant of a patent on the basis of this application.

Signature

[Signature]

Date

3 November 1998

MATHYS & SQUIRE

12. Name and daytime telephone number of person to contact in the United Kingdom

Peter D Garratt - 0171 830 0000

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Film Sequence Detection [NT4]

This invention relates to improved methods of processing television signals which have been derived from cinema film, or other camera processes having a temporal sampling rate lower than the field rate of the television system.

There are several processes in which two or more fields of a television signal are arithmetically combined to provide a filtered or interpolated output signal. Examples include geometric transformation of the picture for special effects, aspect-ratio conversion and standards conversion. These processes can give rise to undesirable artefacts when the fields which are combined differ significantly because of motion, or cuts between different scenes. When the temporal sampling rate of the camera is less than the field rate of the television system the opportunity arises to modify the processing so that only fields corresponding to the same instant in time are combined.

A particularly important example of the problem is the televising of film shot at 24 frames per second at a field rate of 60 fields per second. It is common practice to create a sequence of five television fields from two film frames by alternately generating two and three fields respectively from successive film frames. This is known as the "3:2 pulldown" technique. Another important example is the televising of film shot at 25 frames per second at a field rate of 50 fields per second. In this case, it is common practice to create two television fields from each film frame. This is sometimes known as the "2:2 pulldown" technique.

In order to modify processes which combine fields inappropriately it is helpful to derive a signal which indicates when a change in the "temporal phase" of the picture, or a cut to a new scene, occurs. Such signals have been generated in the past by subtracting video signals which have been delayed by integer numbers of lines substantially equal to one or more fields. A "film sequence" signal can be derived by observing how the magnitude of the resulting difference signal changes.

This derivation is complicated when (as is almost always the case) interlaced television scanning is used. The lines of successive fields are vertically misaligned by one line pitch and so, where vertical detail exists, the magnitude of the difference signal will not fall to zero, even if the fields correspond to the same scene and temporal phase.

The invention seeks to overcome this difficulty with a method of creating a film sequence signal by subtracting video signals from different fields characterised in that the result of the subtraction is corrected by taking a measure of local vertical detail from one or both of the fields and either all or a proportion of the local detail measure is subtracted from the field difference signal.

In a further aspect one or both of the signals from different fields are vertically interpolated by taking weighted sums of lines from within the same field so as to obtain signals corresponding to similar vertical positions.

In yet another aspect the uncorrected field difference signal is summed over all or a substantial part of the picture to create a global difference signal and the local detail from one or both fields is summed over all or a substantial part of the picture to create

a global detail signal and a film sequence signal is obtained by subtracting all or a proportion of the global detail signal from the global difference signal.

The invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a block diagram of a system for generating a film sequence signal from a 625-line interlaced television signal.

Figure 2 shows an improvement to part of the system of Fig. 1.

Figure 3a shows how a signal from the previous field can be interpolated to give a signal corresponding to the vertical position of the current field.

Figure 3b shows how signals from both the current and the previous fields can be interpolated to bring them into alignment with each other.

Referring to Fig. 1: An interlaced, 625-line input video signal (1) is delayed by 312 lines to produce video signal (2) corresponding to the previous field. This signal is interpolated by averaging (3) across a one-line delay so as to make a signal (4) corresponding to the same vertical position as the (interlaced) current input line. This is subtracted from the input signal and the absolute value of the result taken to give an uncorrected film sequence signal (5) having a magnitude which increases with the difference in content between the current and previous fields.

The vertical interpolation of the previous field to align it with the current field is shown diagrammatically in Fig. 3a. The lines of the current and previous fields are indicated by crosses, and their relative vertical positions are indicated by their vertical positions on the diagram. The position of the interpolated line is shown by a circle.

Returning to Fig. 1, a local measure of the vertical detail in the previous field (7) is taken by subtracting (6) across the one-line delay and taking the absolute value of the result. This is multiplied (8) by a constant k_1 , which is chosen to optimise the operation of the circuit. A suitable value for k_1 may be in the region of 0.5.

The resulting local detail correction signal is subtracted (9) from the uncorrected film sequence signal and clipped (10) in a threshold circuit which replaces values which are more negative than a predetermined threshold by the value of the threshold. This corrected film sequence signal (11) can be used to find cuts or changes in temporal phase of the incoming video.

The signal 11 can be further improved by integrating over all, or a substantial part, of the picture area (12) to make a global difference signal, and carrying out a similar process on the local detail signal (7) to make a global detail signal (13). This is multiplied (14) by a constant k_2 (which determined in a similar way as k_1) and subtracted from the global difference signal to generate an improved film sequence signal 15.

Another way of generating the uncorrected film sequence signal and the local detail signal is shown in Fig. 2.

The input 625-line interlaced video signal (1) is interpolated (21) to produce a signal which is vertically shifted by half of one (picture) line pitch. A second interpolator (22) applies an equal shift in the opposite direction to the signal from the previous field. The two interpolated signals are subtracted (23) and the absolute value of the result taken to obtain an improved local difference signal 27.

The interpolation of the two signals to bring them into vertical alignment is shown diagrammatically in Fig. 3b.

Because the interpolation processes need signals from more than one line from the current and the preceding field (two from each in the example shown in Fig. 2), it is possible to generate local detail signals from each of these fields (24 and 25) by taking the absolute values of vertical difference signals. The two local detail signals are averaged (26) and the result used to correct the improved local difference signal 27.

The local detail signal 28 and the local difference signal 27 can replace the signals 7 and 5 respectively in Fig. 1 and be processed as shown on the right hand side of the figure to create an improved film sequence signal.

Although the invention has been described in terms of 625-line, interlaced signals, it will be appreciated by those skilled in the art that it is applicable to other formats, including 525-line and high-definition formats.

Claims

1. A method of creating a film sequence signal by subtracting video signals from different fields characterised in that the result of the subtraction is corrected by taking a measure of vertical detail from one or both of the fields and a proportion of the detail measure is subtracted from the field difference signal.
2. A method according to Claim 1 in which a measure of local detail is used to correct the field difference signal.
3. A method according to Claim 2 in which a measure of global detail is derived by summing the local detail from one or both fields over all or a substantial part of the picture and a proportion of the global detail signal is used to correct the field difference signal.
4. A method of creating a film sequence signal by subtracting video signals from different fields characterised in that one or both of the fields are vertically interpolated prior to subtraction by taking weighted sums of lines from within the same field so as to obtain signals corresponding to similar vertical positions.
5. A method according to Claim 4 in which the result of the subtraction is corrected by taking a measure of vertical detail from one or both of the fields and a proportion of the detail measure is subtracted from the field difference signal.
6. A method according to Claim 5 in which a measure of local detail is used to correct the field difference signal.
7. A method according to Claim 6 in which a measure of global detail is derived by summing the local detail from one or both fields over all or a substantial part of the picture and a proportion of the global detail signal is used to correct the field difference signal.
8. A method according to either Claim 2 or Claim 6 in which the uncorrected field difference signal is summed over all or a substantial part of the picture to create a global difference signal and the local detail from one or both fields is summed over all or a substantial part of the picture to create a global detail signal and a film sequence signal is obtained by subtracting all or a proportion of the global detail signal from the global difference signal.
9. Apparatus for the geometric transformation of television pictures for special effects in which an interpolation process is modified in response to a field difference signal derived in accordance with any of the above Claims 1 to 8.
10. Apparatus for aspect ratio conversion of television pictures in which an interpolation process is modified in response to a field difference signal derived in accordance with any of the above Claims 1 to 8.
11. Apparatus for standards conversion of television pictures in which an interpolation process is modified in response to a field difference signal derived in accordance with any of the above Claims 1 to 8.

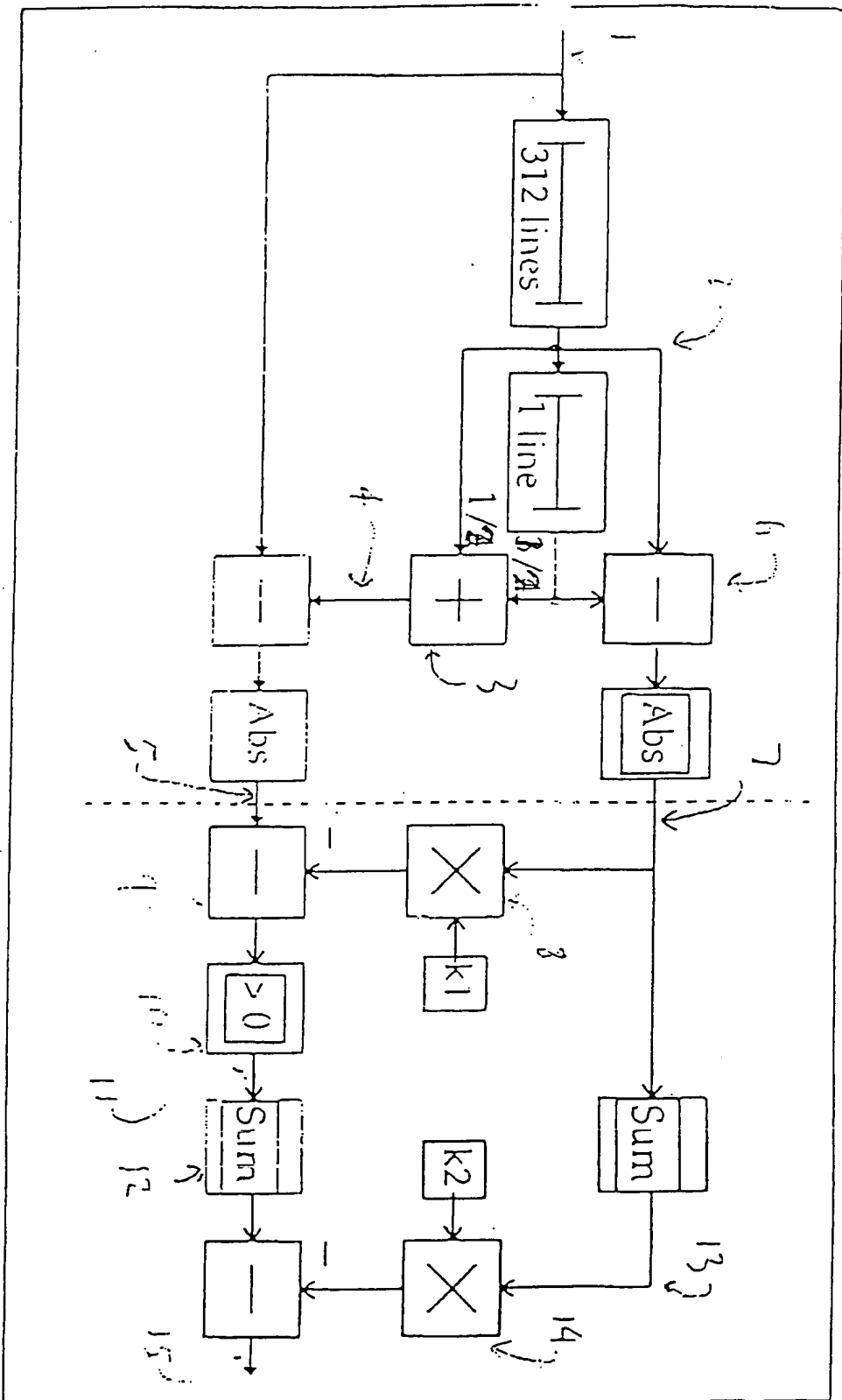


Figure 1

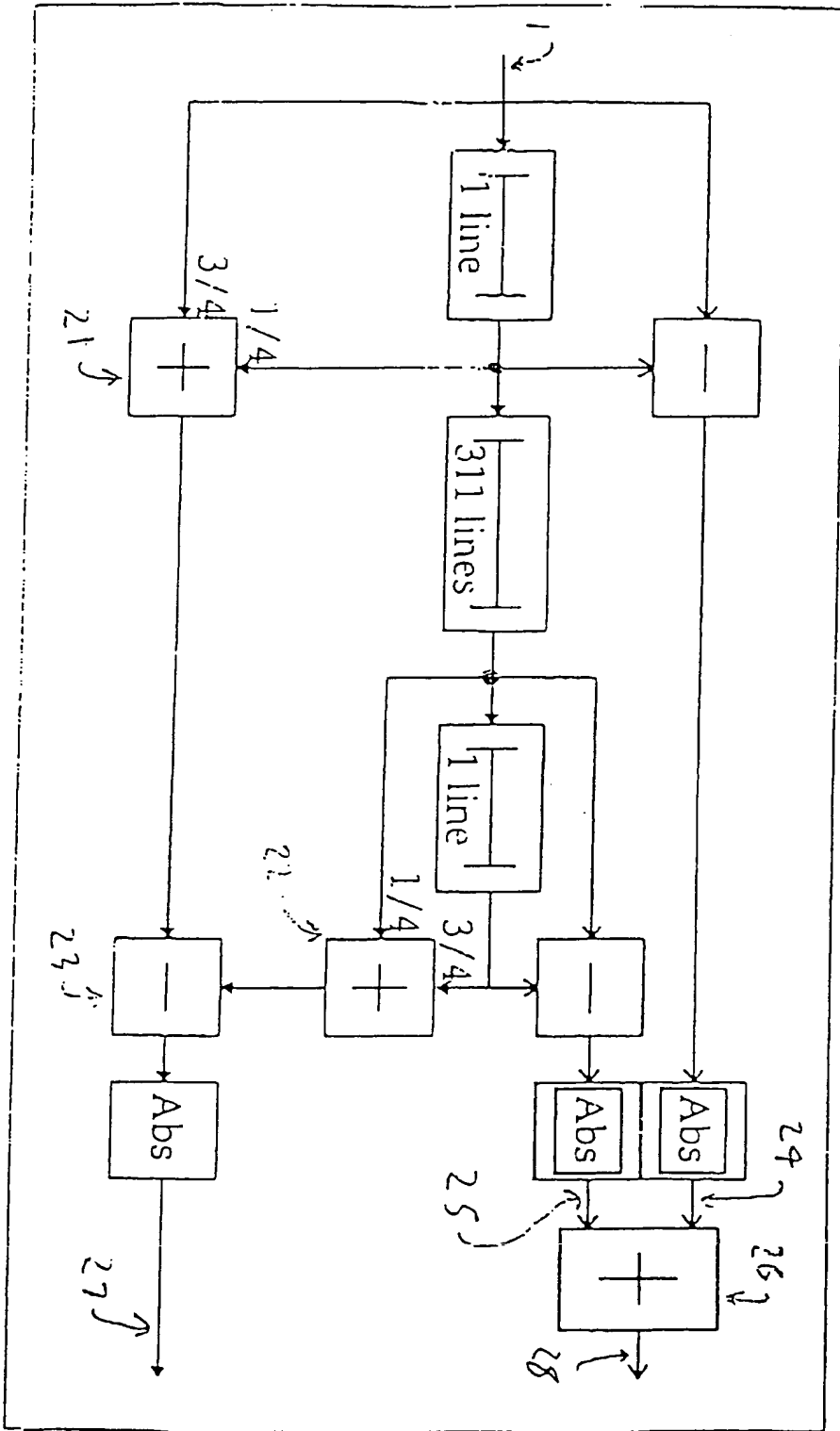


Figure 2

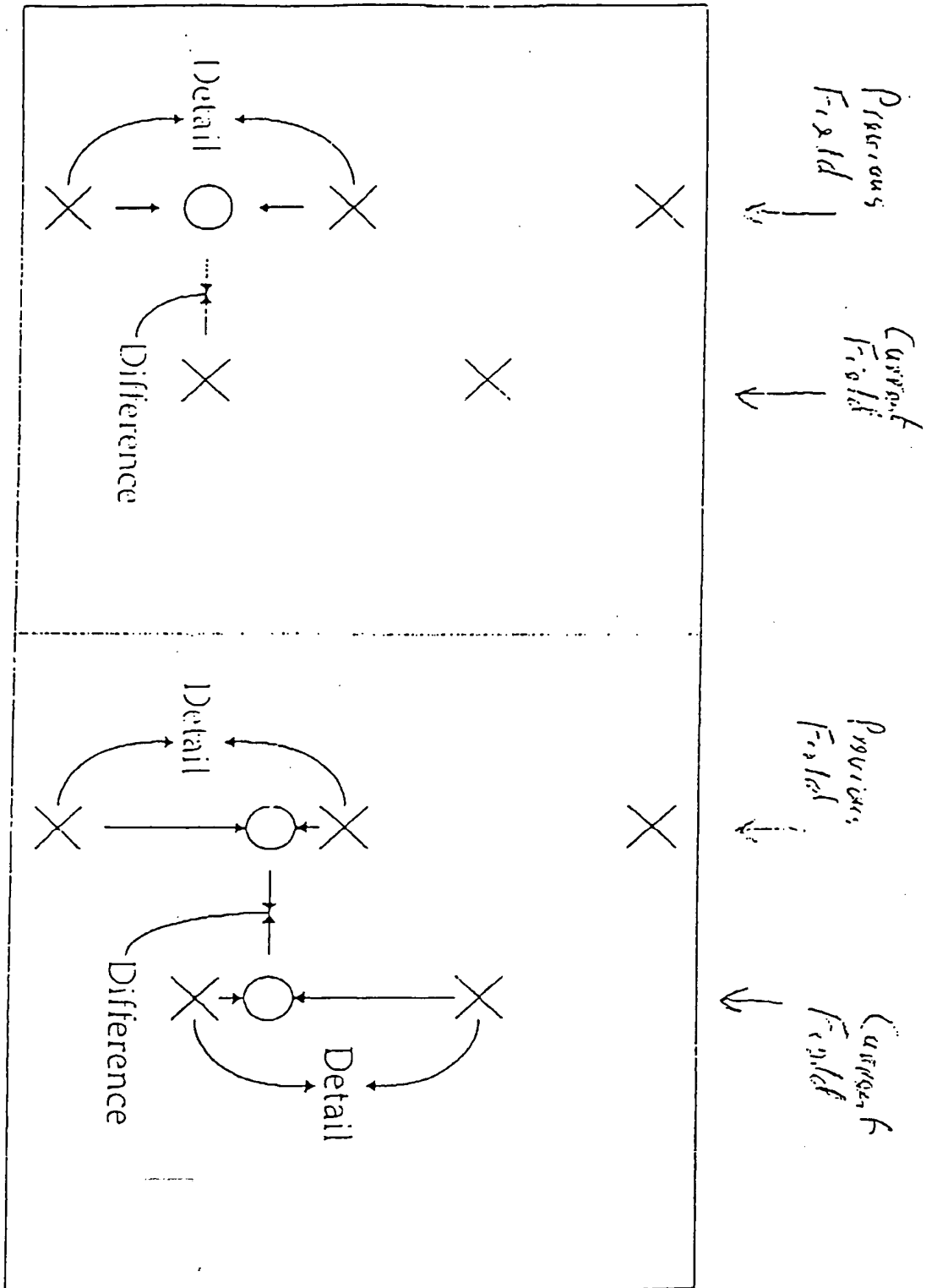


Figure 3A

Figure 3B